

## CLAIMS

The invention claimed is:

1. An apparatus for opening and closing a valve having a first and a second opening and a first and a second position corresponding to either a fully open or fully closed position, said apparatus comprising:

a valve controller operatively connected to said valve such that said valve is normally disposed at said first position when said pressure at said first opening is less than a maximum pressure and said valve is disposed at said second position when said pressure at said first opening exceeds said maximum pressure.

2. The apparatus as claimed in claim 1 wherein said valve controller comprises:

a body defining a first cavity having a base region and an opening region, said cavity including an indentation disposed proximate said opening region, said indentation sized to accept a portion of a ball;

a plunger having a first and a second oppositely disposed end region, said plunger disposed within said first cavity, said second end region including a notch region and a guide region;

a biasing mechanism adapted to be disposed within said first cavity between said base region of said body and said first end region of said plunger; and

a cap disposed within said first cavity, said cap defining a second cavity having a base and at least one leg extending therefrom, said at least one leg sized and shaped to fit within said notch region of plunger such that said at least one leg contacts said ball.

3. The apparatus as claimed in claim 2 wherein said guide region includes a channel.

4. The apparatus as claimed in claim 2 wherein said biasing mechanism includes a spring.

5. The apparatus as claimed in claim 4 wherein said valve controller further includes a device for adjusting the biasing force of said spring.

6. The apparatus as claimed in claim 2 wherein said indentation includes a circumferential slot.

7. The apparatus as claimed in claim 2 wherein said guide region is disposed within said plunger such that a first end of

said guide region is proximate an outer surface of said plunger and a second end of said guide region is disposed proximate said second end region of said plunger.

8. The apparatus as claimed in claim 2 wherein said guide region includes a first and at least a second channel oppositely disposed about said plunger, said first and said second channel sized and shaped to accept a portion of a first and at least a second ball.

9. The apparatus as claimed in claim 2 wherein said valve opens proportionally to a pressure difference between a first maximum pressure and a pressure at said outlet such that said valve opens further as said pressure difference increases and wherein said valve controller fully opens said valve at all times when said outlet pressure is below a second maximum pressure and automatically fully closes said valve when said outlet pressure reaches said second maximum pressure.

10. The apparatus as claimed in claim 2 wherein first opening includes an inlet, said second opening includes an outlet, said first position includes said fully closed position, and said second position includes said fully open position.

11. The apparatus as claimed in claim 2 wherein first opening includes an inlet, said second opening includes an outlet, said first position includes said fully open position, and said second position includes said fully closed position.

12. A pressure regulator comprising:

a valve which is proportionately opened in relation to a pressure difference between a first maximum pressure and an outlet pressure such that said valve opens proportionate to said pressure difference; and

a quick fill device operatively connected to said valve, said quick fill device overriding said pressure regulator such that said valve is fully open at all times when said outlet pressure is below a second maximum pressure and automatically fully closes said valve when said outlet pressure reaches said second maximum pressure.

13. The pressure regulator as claimed in claim 12 wherein said quick fill device comprises:

a body defining a first cavity having a base region and an opening region;

a plunger disposed within said first cavity of said body, said plunger operatively connected to said pressure regulator;

a biasing mechanism disposed within said first cavity between said base region of said body and said plunger; and

an actuator disposed in said cavity and coupled to said plunger, wherein said actuator forces said plunger into a first position fully opening said valve when an outlet pressure of said valve is below a maximum pressure and wherein said outlet

pressure of said valve forces said plunger into a second position automatically and fully closing said pressure regulator when said outlet pressure reaches said maximum pressure.

14. The pressure regulator as claimed in claim 13 wherein said cavity including a circumferential slot disposed proximate said opening region, said circumferential slot sized to accept a portion of a ball.

15. The pressure regulator as claimed in claim 14 wherein said plunger includes a notch region and a guide region, wherein said guide region is disposed within said plunger such that a first end of said guide region is proximate an outer surface of said plunger and a second end of said guide region is disposed proximate said second end region of said plunger.

16. The pressure regulator as claimed in claim 15 further including a biasing mechanism disposed within said first cavity between said base region of said body and said first end region of said plunger.

17. The pressure regulator as claimed in claim 16 wherein said actuator further includes a cap disposed within said first cavity, said cap defining a second cavity having a base and at

least one leg, said at least one leg sized and shaped to fit within said notch region of plunger such that said at least one leg contacts said ball.

18. A relief valve comprising:

a valve having an inlet and an outlet; and

a valve controller operatively connected to said valve such that said valve is fully closed at all times when a pressure at said inlet is lower than a predetermined maximum pressure and said valve is fully open at all times when said inlet pressure exceeds said maximum predetermined pressure.

19. The relief valve as claimed in claim 18 wherein said valve controller comprises:

a body defining a first cavity having a base region and an opening region;

a plunger disposed within said first cavity of said body, said plunger operatively connected to said relief valve;

a biasing mechanism disposed within said first cavity between said base region of said body and said plunger; and

an actuator disposed in said cavity and coupled to said plunger, wherein said actuator forces said plunger into a first position fully closing said valve when said inlet pressure of said valve is below a maximum pressure and wherein said inlet pressure of said valve forces said plunger into a second position automatically and fully opening said pressure regulator when said inlet pressure reaches said maximum pressure.



20. The relief valve as claimed in claim 19 wherein said cavity including a circumferential slot disposed proximate said opening region, said circumferential slot sized to accept a portion of a ball.

21. The relief valve as claimed in claim 20 wherein said plunger includes a notch region and a guide region, wherein said guide region is disposed within said plunger such that a first end of said guide region is proximate an outer surface of said plunger and a second end of said guide region is disposed proximate said second end region of said plunger.

22. The relief valve as claimed in claim 21 further including a biasing mechanism disposed within said first cavity between said base region of said body and said first end region of said plunger.

23. The relief valve as claimed in claim 22 wherein said actuator further includes a cap disposed within said first cavity, said cap defining a second cavity having a base and at least one leg, said at least one leg sized and shaped to fit within said notch region of plunger such that said at least one leg contacts said ball.